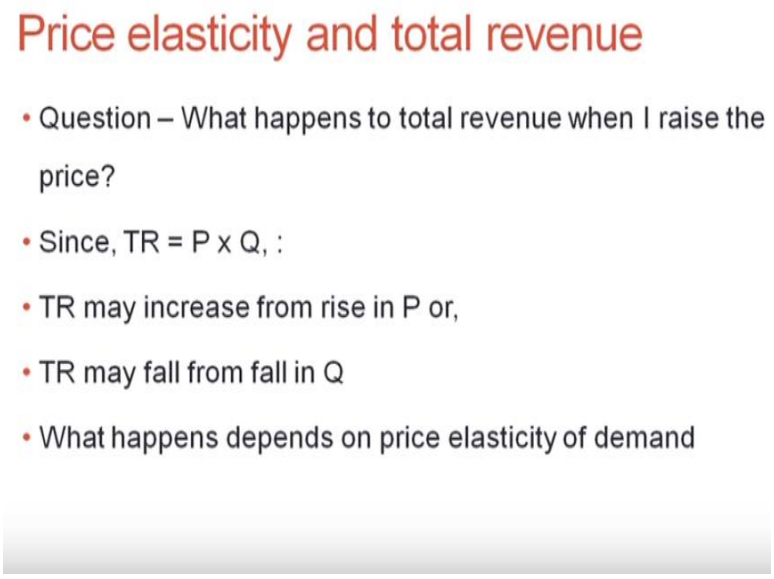
Foundation Course in Managerial Economics
Prof. Barnali Nag
Vinod Gupta School of Management
Indian Institute of Technology-Kharagpur

Lecture - 08
Elasticity and Revenue

Welcome back to the foundation course in managerial economics. I am Dr. Barnali Nag from VGSoM, IIT Kharagpur. We had started off with discussing about demand and supply and then we went ahead to discuss about what elasticity is and if you may remember we had started the entire discussion on elasticity with talking about what does a producer do when he is in the dilemma whether to increase his price or not because from the law of demand he knows that if he increases the price the quantity demanded is going to go down but he would like to know if the reduction in quantity is going to be compensated by the increase in price.

That is how responsive quantity demanded is to price is what he is looking for. So to continue with that discussion we are going to show here in this lecture how price elasticity is related to the revenue that a producer may expect when he is changing the price of his product.

(Refer Slide Time: 01:34)

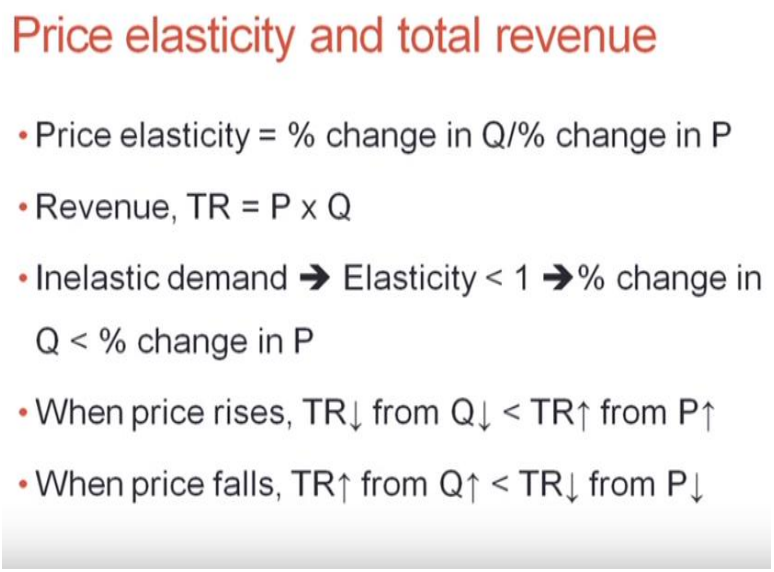


So the question basically that we are asking is what happens to total revenue when I raise the price. Now since total revenue is equal to price multiplied by quantity total revenue may increase from rise in price or total revenue may fall from fall in quantity. So from the from this equation of total revenue equals price into quantity there are 2 components price and quantity and

whenever there is any change in price quantity moves in the opposite direction. So the quantity is how much is the increase or decrease in price and related to that how much is the decrease or increase in quantity respectively the 2 cases.

So what happens depends on price elasticity of demand. Price elasticity of demand is going to tell us that what happens when price changes. Is the price affect more or the quantity affect more. So to continue with the discussion and to illustrate a little more, price elasticity and total revenue.

(Refer Slide Time: 02:53)

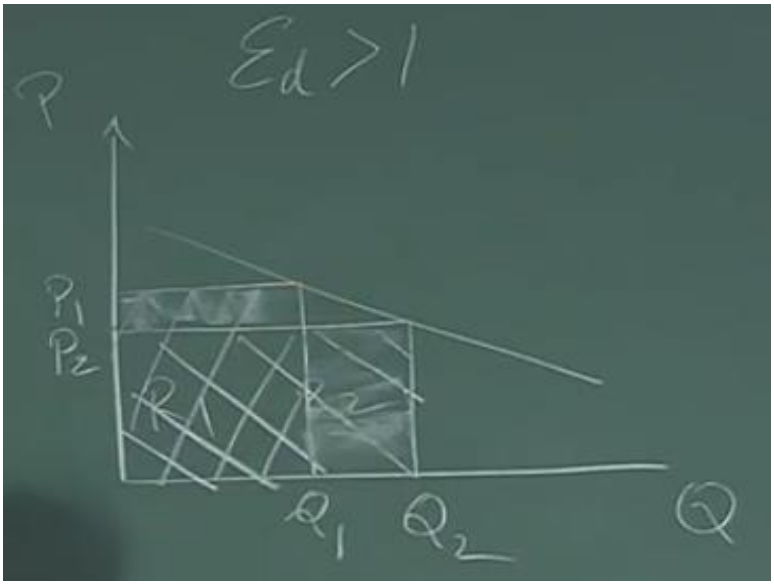


So price elasticity again going back to the definition of price elasticity is percentage change in quantity divided by the percentage change in price and revenue is P multiplied by Q. So whenever we have a inelastic demand that is elasticity is less than 1 that implies that the numerator is smaller than the denominator in the very first line where we have defined price elasticity. So elasticity less than 1 implies percentage change in quantity is less than percentage change in price.

So when price rises total revenue fall from decline in quantity and that decline is less than the total revenue the increasing impact of price increase that happens on total revenue that is when it is a inelastic demand the quantity effect or the fall in revenue from a fall in quantity is less than the increase in revenue from increase in price and similarly when price falls it is exactly the opposite effect that is revenue increase from quantity increase is actually less than revenue decrease from price decrease.

So what does that mean? That means to say that if it is a inelastic demand it makes sense to increase the price because when you are increasing the price the price increase the impact of the price increase increases total revenue and that increase is more than the fall in quantity that happens because price is risen and the fall in quantity pulls down the total revenue but that impact is less than the impact of a rise in prices to so in a nutshell it makes sense to increase the price when it is inelastic demand. Okay so let me illustrate through a diagram also. So let me illustrate through a diagram.

(Refer Slide Time: 05:15)



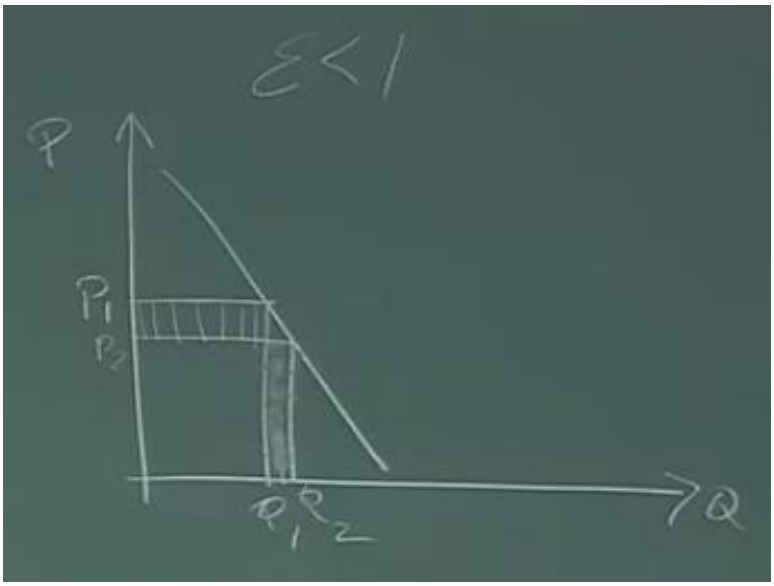
So this is the case of a elasticity demand curve. So this is a very elasticity demand curve where price elasticity is more than 1. So this is a elasticity demand curve and when price falls this is P 1 this is Q 1 and there is a fall in price the producer decides that I am going to reduce the price. So the price falls to P 2 and the quantity falls to Q 2.

Now before the price fall what is the total revenue? Total revenue is P multiplied by Q which is this area, this is the revenue 1. This is the portion that the producer was earning as revenue before there was any price change but when price fell to P 2 and quantity increased to Q 2 first of all we can see that the quantity increase here this is more than the price fall which is shown by this portion.

Also, what is the new revenue? The new revenue is this area. This is P 2 into Q 2 and this is the new revenue. So the additional amount of revenue that that the producer gets is this area and the revenue that he has foregone by reducing the prices, this area. So it looks like from the figure at

least it shows that this rectangle is larger than this rectangle. So the area under this rectangle is larger than the area under this rectangle which kind of shows that if it is a the flatter the slope is the more the revenue is earned when price falls, so in the case of a elasticity demand. So let me draw the case of a inelastic demand.

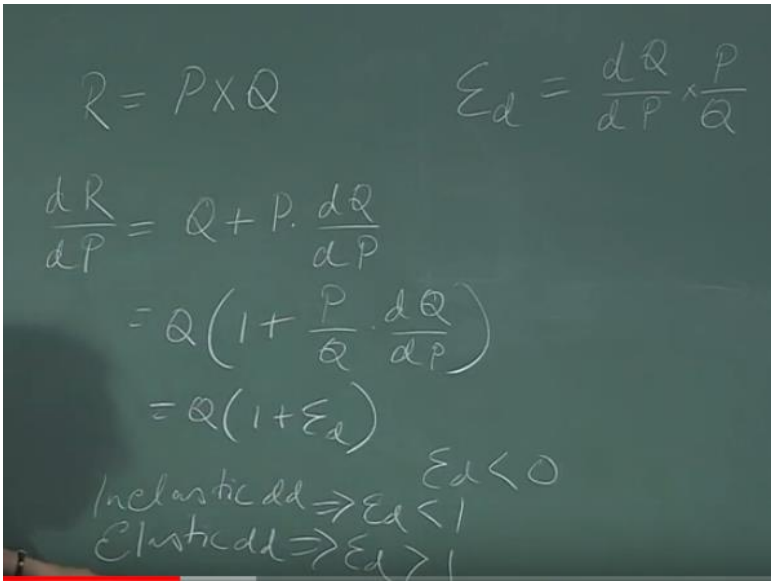
(Refer Slide Time: 07:31)



What happens in the case of a inelastic demand? So this is P and this is a steep or elasticity is less than 1. This is inelastic demand. So in the case of inelastic demand the same price fall. This is P 1, Q 1 and price falls to price falls to P 2 and quantity increases to Q 2. Here the additional revenue that the producer gets is this very narrow rectangle and the amount that he foregoes is this upper rectangle.

So through the figures it is kind of intuitively it can be shown or graphically that the amount of revenue gained when there is a price fall through increase in revenue is much lesser in case of a inelastic demand. So this was illustration through diagram. Let me also complete the discussion by using a little bit of calculus.

(Refer Slide Time: 09:13)



So using calculus now revenue as we wrote earlier is P multiplied by Q. Now we would like to see what happens to revenue when there is price change. So this we can write as and also let us write the definition of elasticity of demand in terms in mathematical form. This is dQ dP multiplied by P by Q.

That is change in quantity divided by percentage change in quantity divided by percentage change in price. This is elasticity of demand. So whenever there is price change then dR dP can be written as Q + P into dQ dP or taking the Q out it can be written as 1 + P by Q into dQ dP and this portion is nothing but the elasticity of demand so this is equal to 1 plus elasticity of demand.

So it is very clear from here what happens to changes change in revenue is more or less than the existing revenue is very clear from this expression. So when it is a inelastic demand and price elasticity of demand being less than curve price elasticity of demand this is always negative. So elasticity of demand is always negative and when this expression when it is a inelastic demand there is a increase in quantity.

This is a positive expression when inelastic demand implies elasticity of demand is less than 1 and elasticity demand implies elasticity of demand is more than 1. So in case of elastic demand when elasticity is more than 1 this expression becomes negative or in other words when there is a price change the revenue change happens in the opposite direction.

So what is the intuition behind it? The intuition behind it all whatever we showed graphically, through calculus, and through the by reasoning, the intuition behind this is basically that if it is a

inelastic demand, say for example we took the example of say medicine, lifesaving medicine. So it is a it has a very inelastic demand. So what happens when price changes?

When price increases people are not going to cut back on consumption too much because it is a necessity. They have to buy it in any case. So that is the reason when price increases the quantity reduction or cut in quantity demand is not so much so the revenue increases in case of a inelastic demand when price increases and the opposite thing happens when price falls.

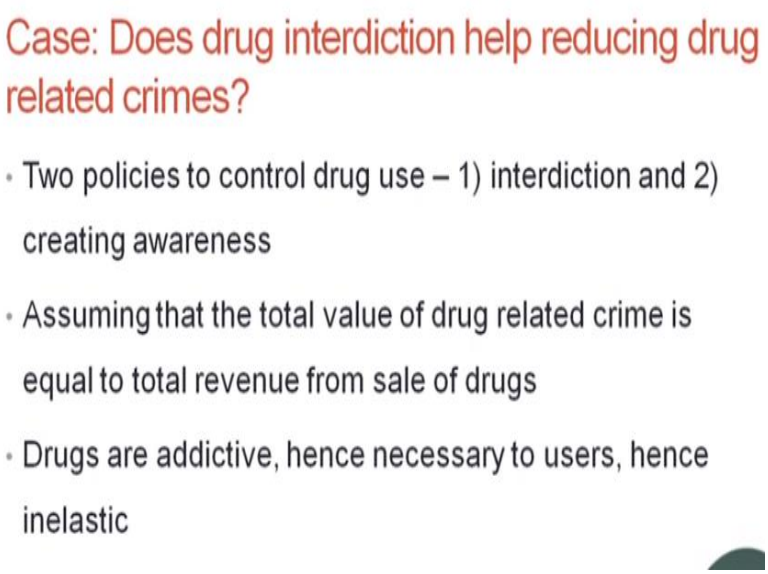
When price falls in normal circumstance or the law of demand says that when price falls consumption is going to increase but here what is happening in case of inelastic demand which is a necessity necessary good and in most cases necessary goods are something which you consume in a certain given amount. So in most of the circumstance necessary goods it is a inelastic demand where if price falls you are not going to increase your consumption too much.

So in that case the quantity effect or the effect of a increase in quantity because price has fallen that does not happen so much and so it does not make much sense to reduce the price and exactly the opposite thing happens in case of a elasticity demand.

Elasticity demand we took the example of luxury goods say and in case of luxury goods you can imagine if the price falls you would like to take the advantage and consume more but if there is a price increase it is not a necessary good and you can just as well give it up for some time or cut down your consumption or postpone your consumption. It is much more flexible and because it is flexible it is a elasticity demand.

So this was our discussion on elasticity inelastic demand and what that does to revenue and let us end the discussion with a typical case. It is it is this example is given in one of the text books that I have recommended, Principles of Economics by Mankiw and I have borrowed this example from there and this case says does drug interdiction help reducing drug related crimes?

(Refer Slide Time: 14:54)



So you there are basically you can imagine 2 policies to control drug use. Say for example you would like to obviously you would strongly like to reduce the use of drugs among youngsters, among people, among your citizens and what can you do for that? One is you could use a very strict method of interdiction very severe punishments if you are caught with drugs and second is you could create awareness.

So we are going to take this example of elasticity, supply, demand whatever we have learnt so far to see what happens in each of these cases. Now slightly to illustrate the example we also assume that the total value of drug related crime is equal to total revenue from sale of drugs. So we are trying to quantify that what is the impact of each of these policies and how do we quantify?

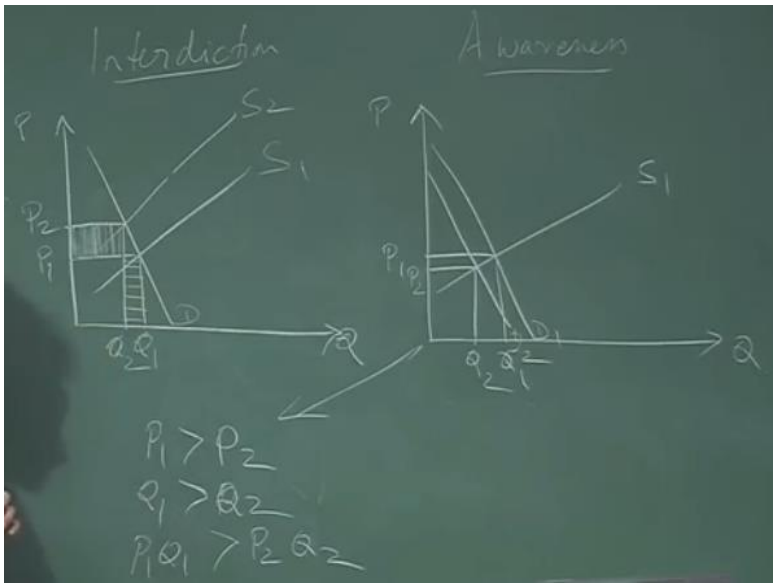
First we quantify if we are talking about drug related crimes what is the measure of that maybe we the measure we can take assume that the measure is the amount of drug that is sold or the amount of expenditure that people do on drugs by buying drugs or the amount of revenue that the drug vendors or peddlers they earn by selling the drugs and drugs are addictive hence they are necessary to users.

So they are addictive so one might assume that the consumers of drug, the people who consume the drugs are not so much price sensitive. That is no matter what the price of the drug is they would nevertheless like to buy the drugs. So the drugs we can assume that it has a very inelastic demand curve. So now let us see what happens in each of the 2 cases.

Now if the in the case of the first policy of interdiction as we discussed in the earlier classes that whenever any disturbance in the system is introduced or proposed how do we figure out that which what happens in the market. To figure that out what was the first step? The first step was that we have to find out which of the two demand and supply graphs does this impact. So here there is interdiction or there is a strong message to the people that there is severe punishment if you are caught selling drugs.

So in that case what happens? Which of the two demand and supply which of the two curves is affected. Obviously the supply curve is affected. So if there is interdiction there is a supply curve is affected. There is fear among the sellers of drugs and it probably is successful in cutting down the supply of drugs that less people are willing to sell drugs or maybe the they are more they have they are selling the same drugs probably but for them their cost has gone up. They have to be even more careful and so the price for that the cost at which they can sell the drugs that goes up and when cost goes up what happens?

(Refer Slide Time: 18:20)



So first let us draw the demand curve for drugs. So it is a very steep demand curve where inelasticity it is a inelasticity demand curve and elasticity of demand is less than 1 and this is the demand curve for drugs and say this was the supply curve. This was the initial supply curve and this was the initial price and quantity. This was the equilibrium initially. Now there is interdiction. So when interdiction happens what happens? The supply curve shifts to the left.

So it is costlier for the suppliers to supply the drugs. So when supply curve has shifted to the left price increases and quantity falls, quantity falls. So yes the policy is successful in reducing the amount of drugs sold to the community. So the amount falls from Q 1 to Q 2 but we have measured the drug related crime as the total revenue or the total amount of drug trading that is happening in the economy.

So we can see clearly from here that this is the revenue that is foregoing that the drug sellers are foregoing and this is the additional revenue that they are getting because drug has become more expensive and from here we can see clearly see that this is a bigger rectangle. This is a bigger rectangle and you can probably do this yourself and try to see like try to draw the demand curve steep or flat and try to do this and you will clearly see that the revenue actually increases in this case.

So the revenue actually increases in this case or in other words here the price increase that happens because supply has fallen actually leads to lesser fall in quantity. The fall in quantity is not so much because it is inelastic demand and as a result the amount of drug related crimes the way we have measured the drug related crimes that actually goes up and this is the example of interdiction.

Now what happens in the case of awareness if you are creating awareness what happens in that case? There also you have a steep demand curve D 1 and the supply curve S 1. Now in case of awareness which of the 2 curves is affected. In case of awareness where are you creating the awareness. You are basically creating the awareness among people who use the drugs.

So when awareness goes up the demand for drugs goes down. So when demand for drugs goes down the demand curve shifts to the left. So this is the new demand curve and in this case the earlier equilibrium was P 1 Q 1 and the new equilibrium is P 2 Q 2.

So not only has the quantity demanded fallen, the price has also fallen because demand has fallen and in total the PQ has fallen PQ is much less than the initial PQ. So P 1 here so P 2 is less than P 1. Q 2 is less than Q 1 and P 1 Q 1 is much more than P 2 Q 2 which shows that in case of awareness when you create awareness let me write it here maybe the it is camera is this is blocking the camera and so in the second case in case of the awareness what is happening is P 1 is more than P 2. Q 1 is more than Q 2 and P 1 Q 1 is more than P 2 Q 2.

So the new revenue is much less than the earlier revenue. So this basically shows that the two this is a very interesting example of how elasticity can be applied and how the shift in demand

and supply curves the discussion that we started with in the first case that can be illustrated through this kind of example.

So this example basically shows that if it is a inelastic demand curve and there is the so a change in the supply as against a change in demand actually creates less impact in case of a inelastic demand curve and to end the discussion another point which is worth noting is when the supply change changes when supply changes movement is along the demand curve movement is along the demand curve and when demand changes movement is along the supply curve which means to say that when supply changes the consumers feel the impact of change in prices and they respond along the demand curve and when demand changes or demand shifts the suppliers feel the price change and they respond to the price change and they do that against the or along the supply curve.

So that ends our discussion on elasticity of demand and how it can be used to explain changes in revenue and when a when a producer decides whether to change the price or not the producer needs to understand what would be the impact of a price change on the total revenue that he can expect because he knows the producer knows that the producer knows the law of demand and the producer knows that there is a negatively sloping demand curve that he is facing and whenever there is a change in price that is going to reduce the that is going to change the quantity as well.

So that ends our discussion. We are going to talk about supply in the, elasticity of supply in the next lecture. Thank you.